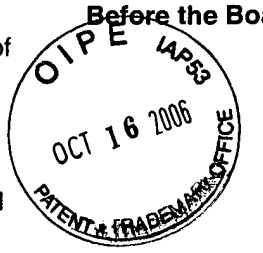
IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
Before the Board of Patent Appeals and Interferences

In re Patent Application of
POWERS et al
Serial No. 09/743,898
Filed: January 17, 2001



Atty Dkt. 36-1406
C# M#
TC/A.U.: 2194
Examiner: C. Anya
Date: October 16, 2006 (Monday)
(October 15 = Sunday)

Title: PREDICTING AVATAR MOVEMENT IN A DISTRIBUTED VIRTUAL ENVIRONMENT

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

☐ **Correspondence Address Indication Form Attached.**

☐ **NOTICE OF APPEAL**
Applicant hereby **appeals** to the Board of Patent Appeals and Interferences from the last decision of the Examiner twice/finally rejecting applicant's claim(s). $500.00 (1401)/$250.00 (2401) $

☒ An appeal **BRIEF** is attached in the pending appeal of the above-identified application $500.00 (1402)/$250.00 (2402) $ 500.00

☐ Credit for fees paid in prior appeal without decision on merits -$ ( )

☐ A reply brief is attached. **(no fee)**

☒ Petition is hereby made to extend the current due date so as to cover the filing date of this paper and attachment(s)
One Month Extension $120.00 (1251)/$60.00 (2251)
Two Month Extensions $450.00 (1252)/$225.00 (2252)
Three Month Extensions $1020.00 (1253/$510.00 (2253)
Four Month Extensions $1590.00 (1254/$795.00 (2254) $ 450.00

☐ "Small entity" statement attached.

Less month extension previously paid on -$( )

TOTAL FEE ENCLOSED $ 950.00

Any future submission requiring an extension of time is hereby stated to include a petition for such time extension. The Commissioner is hereby authorized to charge any deficiency, or credit any overpayment, in the fee(s) filed, or asserted to be filed, or which should have been filed herewith (or with any paper hereafter filed in this application by this firm) to our **Account No. 14-1140.** A duplicate copy of this sheet is attached.

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Signature:

OIPE IAP53
OCT 16 2006
PATENT & TRADEMARK OFFICE

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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POWERS et al. Atty. Ref.: 36-1406

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For: PREDICTING AVATAR MOVEMENT IN A DISTRIBUTED VIRTUAL ENVIRONMENT

* * * * * * * * * * * *

October 16, 2006
(October 15=Sunday)

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

APPEAL BRIEF

Sir:

Appellant hereby **appeals** to the Board of Patent Appeals and Interferences from the last decision of the Examiner.

10/17/2006 SZEWDIE1 00000130 09743898
01 FC:1402 500.00 OP
02 FC:1252 450.00 OP

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(I) REAL PARTY IN INTEREST

The real party in interest is British Telecommunications public limited company, a corporation of the country of England.

(II) RELATED APPEALS AND INTERFERENCES

The appellant, the undersigned, and the assignee are not aware of any related appeals, interferences, or judicial proceedings (past or present), which will directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

(III) STATUS OF CLAIMS

Claims 1-34 are pending. Claims 1-34 have been rejected. The rejections of claims 1-34 are being appealed. No claim has been substantively allowed.

(IV) STATUS OF AMENDMENTS

A Response was filed on June 12, 2006 (i.e., after the date of the Final Rejection). The Response did not include any further amendment to the claims. No amendment has been filed subsequent to the date of the Final Rejection. The current status of the claims is the same as that presented in the Amendment/Response filed September 29, 2005.

(V) SUMMARY OF CLAIMED SUBJECT MATTER

A listing of each independent claim, each dependent claim argued separately and each claim having means plus function language is provided below including exemplary reference(s) to page and line number(s) of the specification.

1. A terminal for providing a virtual environment interface to server means which maintains said virtual environment as a plurality of zones, comprising: [pg. 15, l. 22 - pg. 16, l. 10]

a client providing a user interface to the virtual environment to allow a user to control an avatar in the virtual environment; and [pg. 16, ll. 11-15]

apparatus for estimating the likelihood of said avatar, under the control of said user in the virtual environment, moving within a predetermined range of a boundary, the apparatus comprising: [pg. 16, ll. 11-27]

recording means for recording the position of the avatar at intervals to obtain movement data; [pg. 16, ll. 16-19; pg. 18, ll. 12-15]

means for storing data as to the relative frequency of occurrence of different categories of said movement; [pg. 19, ll. 10-27; pg. 21, l. 3 - pg. 22, l. 16]

means arranged to read, from the stored data, frequency data for categories of movement such as would correspond to a potential movement of the avatar from its current position into a position within said predetermined range of said boundary; [pg. 20, l. 20 - pg. 21, l. 2; pg. 22, l. 17 - pg. 23, l. 5]

wherein the client is arranged to obtain information from said server means about the status of the adjacent zone before the avatar enters the adjacent zone only when the

likelihood of the avatar moving within the predetermined range of the boundary of said adjacent zone is above a threshold. [pg. 22, l. 17 - pg. 23, l. 5]

2. The terminal according to claim 1 wherein said threshold is determined in dependence upon a cost function. [pg. 13, ll. 10-14; pg. 32, ll. 17-20]

3. The terminal according to claim 1 wherein said threshold is determined in dependence upon the amount of communication traffic and/or the time taken for the communication with the server means. [pg. 13, ll. 10-16; pg. 23, ll. 1-5]

4. The terminal according to claim 1 wherein said means for storing data is arranged to discard data relating to movement after a set period of time. [pg. 8, l. 22 - pg. 9, l. 8; pg. 11, l. 4-10]

5. The terminal according to claim 1 wherein said recording means is adapted to record the position of said avatar at regular intervals of time in said virtual environment. [pg. 8, l. 22 - pg. 9, l. 4; pg. 11, ll. 4-10; pg. 18, l. 10 - pg. 19, l. 7]

6. The terminal according to claim 1 wherein the potential movement of the avatar takes into consideration obstructions to the movement of said avatar within said virtual environment. [pg. 11, ll. 11-25]

7. The terminal according to claim 1 wherein said predetermined range is dependent upon a range of awareness of said avatar within which said avatar can experience the virtual environment. [pg. 11, l. 22 - pg. 12, l. 4]

8. The terminal according to claim 1 wherein said categories of movement are determined by run lengths. [pg. 12, ll. 5-16]

9. The terminal according to claim 1 wherein said categories of movement are determined by run lengths within a predefined corridor. [pg. 12, ll. 5-16]

10. The terminal according to claim 1 wherein said categories of movement are determined by the movement of said avatar into areas around said avatar. [pg. 12, ll. 17-19]

11. The terminal according to claim 1 wherein said categories of movement are determined by directions and distances of movement of said avatar. [pg. 12, ll. 19-21]

12. An apparatus for estimating the likelihood of an avatar, under the control of a user in a virtual environment, moving within a predetermined range of a boundary, the apparatus comprising: [pg. 15, l. 22 - pg. 16, l. 10]

recording means for recording the position of the avatar at intervals to obtain movement data; [pg. 16, ll. 16-19; pg. 18, ll. 12-15]

means for storing data as to the relative frequency of occurrence of different categories of said movement; and [pg. 19, ll. 10-27; pg. 21, l. 3 - pg. 22, l. 16]

means arranged to read, from the stored data prior to the avatar moving across the boundary, frequency data for categories of movement such as would correspond to a potential movement of the avatar from its current position into a position within said predetermined range of said boundary. [pg. 20, l. 20 - pg. 21, l. 2; pg. 22, l. 17 - pg. 23, l. 5]

13. The apparatus according to claim 12 wherein said means for storing data is arranged to discard data relating to movement after a set period of time. [pg. 8, l. 22 - pg. 9, l. 8; pg. 11, l. 4-10]

14. The apparatus according to claim 12 wherein said recording means is adapted to record the position of said avatar at regular intervals of time in said virtual environment. [pg. 8, l. 22 - pg. 9, l. 4; pg. 11, ll. 4-10; pg. 18, l. 10 - pg. 19, l. 7]

15. The apparatus according to claim 12 wherein the potential movement of the avatar takes into consideration obstructions to the movement of said avatar within said virtual environment. [pg. 11, ll. 11-25]

16. The apparatus according to claim 12 wherein said predetermined range is dependent upon a range of awareness of said avatar within which said avatar can experience the virtual environment. [pg. 11, l. 22 - pg. 12, l. 4]

17. The apparatus according to claim 12 wherein said categories of movement are determined by run lengths. [pg. 12, ll. 5-16]

18. The apparatus according to claim 12 wherein said categories of movement are determined by run lengths within a predefined corridor. [pg. 12, ll. 5-16]

19. The apparatus according to claim 12 wherein said categories of movement are determined by the movement of said avatar into areas around said avatar. [pg. 12, ll. 17-19]

20. The apparatus according to claim 12 wherein said categories of movement are determined by directions and distances of movement of said avatar. [pg. 12, ll. 19-21]

21. A system for providing a distributed virtual environment comprising:

one or more servers for maintaining said virtual environment as a plurality of zones, said one or more servers receiving communication from a client to allow a user to control an avatar in the virtual environment; and [pg. 15, l. 22 - pg. 16, ll. 10-15]

an apparatus for predicting the likelihood of said avatar moving within a predetermined range of a boundary of a zone in the virtual environment; [pg. 22, l. 17 - pg. 23, l. 5]

wherein said one or more servers is arranged to communicate with the client to provide information on the status of one or more further zones in the virtual environment

before the avatar enters said one or more further zones when the likelihood of the avatar moving within a predetermined range of the boundary of said one or more further zones predicted by the apparatus is above a threshold. [pg. 15, l. 22 - pg. 16, ll. 11-15; pg. 22, l. 17 - pg. 23, l. 5]

22. The system according to claim 21 wherein said threshold is determined in dependence upon a cost function. [pg. 13, ll. 10-14; pg. 32, ll. 17-20]

23. The system according to claim 21 wherein said threshold is determined in dependence upon the amount of communication traffic and/or the time taken for the communication with the one or more servers. [pg. 13, ll. 10-16; pg. 23, ll. 1-5]

24. A method of operating a computer terminal to provide a virtual environment interface to server means which maintain said virtual environment as a plurality of zones, the method comprising: [pg. 15, l. 22 - pg. 16, l. 10]

controlling a client which provides a user interface to the virtual environment to allow a user to control an avatar in the virtual environment; and [pg. 16, ll. 11-15]

estimating the likelihood of said avatar, under the control of said user in a virtual environment, moving within a predetermined range of a boundary, estimating said likelihood comprising: [pg. 16, ll. 11-27]

recording the position of the avatar at intervals to obtain movement data; [pg. 16, ll. 16-19; pg. 18, ll. 12-15]

storing data as to the relative frequency of occurrence of different categories of said movement; and [pg. 19, ll. 10-27; pg. 21, l. 3 - pg. 22, l. 16]

reading, from the stored data, frequency data for categories of movement such as would correspond to a potential movement of the avatar from its current position into a position within said predetermined range of said boundary; and [pg. 20, l. 20 - pg. 21, l. 2; pg. 22, l. 17 - pg. 23, l. 5]

instructing the client to obtain information from said server means about the status of an adjacent zone before the avatar enters the adjacent zone only when the likelihood of the avatar moving within the predetermined range of the boundary of said adjacent zone is above a threshold. [pg. 22, l. 17 - pg. 23, l. 5]

25. The method according to claim 24 wherein said threshold is determined in dependence upon the amount of communication traffic and/or the time taken for the communication with the server means. [pg. 13, ll. 10-16; pg. 23, ll. 1-5]

26. The method according to claim 24 wherein stored movement data is discarded after a set period of time. [pg. 8, l. 22 - pg. 9, l. 8; pg. 11, l. 4-10]

27. A storage medium readable by a computer, tangibly embodying a program of instructions executable by the computer to carry out a method of operating a computer terminal to provide a virtual environment interface to a server which maintains the virtual environment as a plurality of zones, steps of the method comprising: [pg. 15, l. 22 - pg. 16, l. 10; pg. 13, ll. 17-22]

controlling a client which provides a user interface to the virtual environment to allow a user to control an avatar in the virtual environment; and [pg. 16, ll. 11-15]

estimating the likelihood of said avatar, under the control of said user in a virtual environment, moving within a predetermined range of a boundary, estimating said likelihood comprising: [pg. 16, ll. 11-27]

recording the position of the avatar at intervals to obtain movement data; [pg. 16, ll. 16-19; pg. 18, ll. 12-15]

storing data as to the relative frequency of occurrence of different categories of said movement; and [pg. 19, ll. 10-27; pg. 21, l. 3 - pg. 22, l. 16]

reading, from the stored data, frequency data for categories of movement such as would correspond to a potential movement of the avatar from its current position into a position within said predetermined range of said boundary; and [pg. 20, l. 20 - pg. 21, l. 2; pg. 22, l. 17 - pg. 23, l. 5]

instructing the client to obtain information from said server about the status of an adjacent zone before the avatar enters the adjacent zone only when the likelihood of the avatar moving within the predetermined range of the boundary of said adjacent zone is above a threshold. [pg. 22, l. 17 - pg. 23, l. 5]

28. A computer-implemented method for processing signals related to provide a virtual environment interface to at least one server which maintains said virtual environment as a plurality of zones, the method comprising: [pg. 15, l. 22 - pg. 16, l. 10; pg. 13, ll. 17-22]

controlling a client which provides a user interface to the virtual environment to allow a user to control an avatar in the virtual environment; and [pg. 16, ll. 11-15]

estimating the likelihood of said avatar, under the control of said user in a virtual environment, moving within a predetermined range of a boundary, estimating said likelihood comprising: [pg. 16, ll. 11-27]

recording the position of the avatar at intervals to obtain movement data; [pg. 16, ll. 16-19; pg. 18, ll. 12-15]

storing data as to the relative frequency of occurrence of different categories of said movement; and [pg. 19, ll. 10-27; pg. 21, l. 3 - pg. 22, l. 16]

reading, from the stored data, frequency data for categories of movement such as would correspond to a potential movement of the avatar from its current position into a position within said predetermined range of said boundary; and [pg. 20, l. 20 - pg. 21, l. 2; pg. 22, l. 17 - pg. 23, l. 5]

instructing the client to obtain information from said server about the status of an adjacent zone before the avatar enters the adjacent zone only when the likelihood of the avatar moving within the predetermined range of the boundary of said adjacent zone is above a threshold. [pg. 22, l. 17 - pg. 23, l. 5]

29. In a computer system having at least one server for providing a virtual environment having a plurality of zones in which an avatar may move in response to user control signals received from a client, a method comprising: [pg. 15, l. 22 - pg. 16, l. 10]

monitoring movement of the avatar within the virtual environment for a period of time; [pg. 9, ll. 5-8; pg. 16, ll. 16-19]

determining a pattern of movement of the avatar based on the monitored movement; [pg. 9, ll. 5-8; pg. 16, ll. 16-19]

predicting a likelihood of the avatar, based on the determined pattern of movement, of moving to within a predetermined range of a boundary of a zone in which the avatar is currently positioned; [pg. 16, ll. 19-27; pg. 22, l. 7 - pg. 23, l. 5]

determining whether or not the predicted likelihood exceeds a threshold; and [pg. 22, ll. 22-25]

obtaining information for a zone adjacent to the zone in which the avatar is currently positioned before the avatar enters the adjacent zone when the predicted likelihood exceeds the threshold. [pg. 22, ll. 22-25]

30. The method of claim 29 wherein the threshold is determined in dependence upon a cost function, the amount of communication traffic of the at least one server, or an amount of time taken for the communication with the at least one server. [pg. 13, ll. 10-16; pg. 23, ll. 1-5; pg. 32, ll. 17-20]

31. The method of claim 29 wherein monitoring the movement of the avatar includes obtaining a sliding window of data samples describing the avatar movement. [pg. 11, ll. 4-10; pg. 16, ll. 11-27]

32. The method of claim 29 wherein predicting the likelihood of the avatar of moving to within the predetermined range of the boundary includes considering features within the virtual environment which restricts movement of the avatar. [pg. 11, ll. 11-25]

33. The method of claim 29 wherein predicting the likelihood of the avatar of moving to within the predetermined range of the boundary includes considering features within the virtual environment which restricts an ability of the avatar to experience the virtual environment. [pg. 11, ll. 11-25]

34. The method of claim 29 wherein predicting the likelihood of the avatar of moving to within the predetermined range of the boundary includes referring to a prediction model having a data table of run lengths of avatar movement and corresponding likelihood to cross a zone boundary. [pg. 12, ll. 5-16]

(VI) GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Whether claim 28 is directed to statutory subject matter under 35 U.S.C. §101.

Whether claims 1, 3-5, 7-14, 16-21, 23-29 and 33-34 are "obvious" under 35 U.S.C. §103 over Yerazunis et al (U.S. '382, hereinafter "Yerazunis") in view of Suzuki et al (U.S. '982, hereinafter "Suzuki").

Whether claims 2, 6, 15, 22, 30 and 32 are "obvious" under 35 U.S.C. §103 over Yerazunis in view of Suzuki and further in view of Leahy et al (U.S. '045, hereinafter "Leahy").

Whether 31 is "obvious" under 35 U.S.C. §103 over Yerazunis in view of Suzuki and further in view of Cohen-Or (U.S. '567).

(VII) ARGUMENT

Claim 28 is directed to statutory subject matter under 35 U.S.C. §101:

The Final Rejection states "Specifically, claim 28 [is] directed to 'a computer-implemented for processing signal...' and this is non-statutory." The Final Rejection thus misquotes the invention of claim 28 (as amended) which correctly requires "A computer-implemented method for processing signals related to provide a virtual environment interface...the method comprising...(emphasis added)." The invention of claim 28, as correctly quoted, requires a computer-implemented method which produces a useful, concrete and tangible result such as estimating a likelihood of an avatar moving within a predetermined range of a boundary and/or instructing a client to obtain information from a server about the status of an adjacent zone before the avatar enters the adjacent zone in certain circumstances. Accordingly, claim 28 is clearly directed to statutory subject matter under 35 U.S.C. §101.

Claims 1, 3-5, 7-14, 16-21, 23-29 and 33-34 are not "obvious under 35 U.S.C. §103 over Yerazunis in view of Suzuki.

In order to establish a *prima facie* case of obviousness, all of the claim limitations must be taught or suggested by the prior art and there must be some suggestion or motivation either in the references themselves or in the knowledge generally available to one of ordinary skill in the art to modify the reference or to combine reference teachings. The combination of Yerazunis and Suzuki fails to teach or suggest all of the claim limitations. For example, the combination fails to teach or suggest "wherein the client is arranged to obtain information from said server means about the status of the adjacent zone before the avatar enters the adjacent zone only when the likelihood of the avatar

moving within the predetermined range of the boundary of said adjacent zone is above a threshold," as required by independent claim 1 and its dependents. Similar comments apply to independent claims 24, 27 and 28. Similarly, the combination fails to teach or suggest "obtaining information for a zone adjacent to the zone in which the avatar is currently positioned before the avatar enters the adjacent zone when the predicted likelihood exceeds the threshold," as required by independent claim 29. The combination also fails to teach or suggest "wherein said client is arranged to communicate with the one or more servers to obtain information on the status of one or more further zones in the virtual environment before the avatar enters said one or more further zones when the likelihood of the avatar moving within a predetermined range of the boundary of said one or more further zones is above a threshold," as required by independent claim 21 and its dependents. With respect to independent claim 12, the combination fails to teach or suggest storing frequency data (i.e., probability) of categories of movement corresponding to potential movement of an avatar into a position within a predetermined range of a specified boundary and reading from this stored data prior to the avatar moving across the boundary, frequency data of categories of movement such as would correspond to a potential movement of the avatar from its current position into a position within the predetermined range of said boundary.

Section 7 (page 3) of the Final Rejection apparently admits that Yerazunis fails to teach the above claim limitations. Indeed, section 7 of the final rejection admits "Yerazunis is silent with the reference to the client being arranged to obtain information from said server means about the status of the adjacent zone only when the avatar moving

within the predetermined range of the boundary of said adjacent zone is above a threshold."

Appellant submits that Suzuki fails to remedy the admitted deficiencies of Yerazunis. Page 9, lines 1-2 of the Final Rejection alleges "As to point (1), Suzuki prior art reference is used to determine the likelihood of an avatar moving close to another avatar." Section 8 (page 4) of the Final Rejection, stating "Suzuki teaches the client being arranged to obtain information from said server means about the status of the adjacent zone only when the avatar moving within the predetermined range of the boundary of said adjacent zone is above a threshold (Col. 6 Ln. 1-24, Col. 24 Ln. 28-33)", echoes this allegation. Appellant respectfully disagrees with these allegations. Suzuki does not perform any likelihood or probability determination.

Moreover, the Final Rejection fails to address the limitation relating to obtaining information about the status of an adjacent zone **before** the avatar enters the adjacent zone when the likelihood of the avatar within the predetermined range of the boundary of the adjacent zone is above a threshold. (See, e.g., last paragraph of claim 1). The combination of Suzuki and Yerazunis clearly fails to teach or suggest this limitation.

Col. 6, lines 10-16, col. 10, lines 22-34 and col. 24, lines 28-33 (specifically identified on page 9, lines 1-6 of the Final Rejection) and col. 6, lines 1-24 (specifically identified in section 8 of the Final Rejection) in Suzuki relate to a virtual space system in which the distance d between two avatars is measured until it is less than a predetermined value D. When this occurs, and the degree of eye-to-eye contact between the avatars also satisfies some condition, a server establishes an audio-video channel between the two avatars concerned. If one were to consider the distance d as representing a circular

boundary around one of the avatars, the audio-video channel will be disabled when the other avatar is outside the boundary, and enabled when inside the boundary. This situation is very similar to that described in the prior art section of the present specification, e.g., at page 7, line 14 to page 8, line 21, and results in the disadvantages listed on page 8 of the present specification since the client will have to download information about the adjacent zone when the zone is entered. Again, there is no suggestion of obtaining adjacent zone information prior to moving within that zone based on the likelihood of the avatar moving within a predetermined range of the adjacent zone boundary. No assessment of likelihood or probability is involved in Suzuki as claimed. The comparison of the distance d between two avatars with predetermined value D fails to teach or suggest obtaining zone information prior to moving within that zone and/or an assessment of likelihood or probability as claimed. Accordingly, even if the teachings of Suzuki and Yerazunis were combined as proposed by the Final Rejection, the combination would not have taught or suggested all of the claim limitations.

Appellant respectfully submits that one of ordinary skill in the art would not have been motivated to modify the teachings of Yerazunis in view of Suzuki. Yerazunis describes a transmitting terminal 12 at which user inputs can be made (e.g., to control an avatar), and a receiving terminal 14 which displays graphical output with the aid of smoothing algorithms which mitigate jitter effects. There is no teaching or suggestion of multiple users controlling avatars from separate terminals, nor interaction between avatars. Appellant thus respectfully submits that one of ordinary skill in the art would not look to Suzuki to modify the teachings of Yerazunis. There is no requirement in Yerazunis to provide communication between remote users controlling different avatars.

The rationale presented in the Final Rejection is thus clearly based improperly on hindsight reasoning.

Even assuming *arguendo* that one of ordinary skill in the art were motivated to combine the teachings of Yerazunis and Suzuki, the combination would still not have taught or suggested the further limitations described below. For example, independent claim 1 requires a terminal for providing a virtual environment interface to server means which maintains the virtual environment as a plurality of zones. Subsequent features relate to estimating movement of an avatar in relation to zone boundaries.

In contrast to the allegations of the Final Rejection, Yerazunis fails to teach or suggest zone or zone boundaries. Section 6 (page 3) of the Final Rejection apparently alleges that col. 3, lines 1-18 of Yerazunis discloses zone boundaries. Appellant respectfully disagrees.

Col. 3, lines 1-18 of Yerazunis states the following:

> "...automatically categorizing the information to be transmitted as to the predictability of future motion and applying appropriate smoothing algorithms based upon knowledge of what the characteristics of the future motion are likely to be. In one embodiment the system switches between a linear extrapolation algorithm for hypothesized future locations, linear interpolation for short-term predictable locations, and a Catmull-Rom spline for long term predictable locations.
>
> For instance, a virtual reality environment may have a trolley-car moving within the environment on a fixed course (the trolley track). The path between stops for the trolley is completely determined; the only variable is the starting time. Once the trolley starts to move, it's future position can be exactly predicted as a function of time for the duration of the next track segment. Because motion is known for a long time into the future, the path can be a long, smooth motion. One might even consider the predetermined path to be a 'script' for the trolley-car's motions."

The above passage of Yerazunis makes no reference to a plurality of zones or zone boundaries. The above passage of Yerazunis also makes no reference to estimating movement of an avatar in relation to zone boundaries.

Claim 1 further requires that the terminal comprises (i) a client which provides a user interface to the virtual environment to allow user-control of an avatar, and (ii) apparatus for estimating the likelihood of said avatar, under the control of said user in the virtual environment, moving within a predetermined range of a boundary. Feature (ii) is not disclosed in Yerazunis.

Yerazunis describes a network 10 comprising a transmitting terminal 12 at which user inputs can be made, and a remote receiving terminal 14 at which the result of the user inputs can be viewed, such as movement of an avatar. Yerazunis goes on to describe a system by which the effect of errors in the channel between the two terminals can be overcome by applying, at the receiving terminal, a smoothing algorithm which is determined according to the number of future location points supplied to it by the transmitting terminal. If two or more future points are provided, indicating known motion from, say, a pre-recorded animation, a Catmull-Rom spline function is applied. For short-term motion where at most a single future point is known, linear interpolation is used. For real-time user defined motion, linear extrapolation is used. (See column 4, lines 35-62).

As discussed above, Yerazunis fails to disclose zones or zone boundaries. In Yerazunis, in no way does the user-controlled terminal 12 perform any kind of likelihood or probability estimation with respect to a boundary as is required by claim 1. User-controlled terminal 12 merely sends positional information over the network. All

decision making is performed at the receiving terminal 12, and even then this simply involves noting how many future points are available and, therefore, deciding which smoothing algorithm to use.

With respect to the apparatus for estimating the likelihood of the avatar moving within a predetermined range of the boundary, claim 1 further requires storing data as to the relative frequency of occurrence of different categories of avatar movement.

The term "relative frequency" has a well understood meaning in the art, namely the ratio of the number of observations in a category to the total number of observations. Hence, the table appearing on page 19 of the specification provides an example set of data representing the relative frequency of occurrence of different run length categories. The relative frequency for a run length of 2.0-3.0 is thus the number of occurrences (700) divided by the total number of observations (1000) which is 0.7.

The Final Rejection alleges that col. 7, lines 44-58 of Yerazunis discloses this feature. Appellant disagrees. This passage describes an array of data representing position (XYZ), axis (X) and rotation (ABC) for a particular object at different times. There is no teaching or suggestion of deriving relative frequency data or any apparent reason why such relative frequency data would be derived.

Claim 1 further requires reading from the stored data relative frequency data for categories of movement such as would correspond to potential movement of the avatar from its current position into a position within the predetermined range of the boundary. No such feature is disclosed in Yerazunis. Col. 7, lines 21-28 of Yerazunis discloses:

> "The implementation of the object motion queue 86 is a simple linked list. A graphical object 90 contains a pointer 85 to the first element in the object motion queue. Each object motion queue block

> contains slots for TIME92, X94, Y96, Z98, A100, B102, C104, R106, and a pointer to the next object motion queue block 108. The final block in the object motion queue indicates it as last by having the value 0 as the pointer to next block 110."

The above passage relates to positional elements in a linked list. However, this portion of Yerazunis fails to teach or suggest the above-noted claimed feature. If one considers the Final Rejection's argument that Yerazunis discloses relative frequency data in the form of a PAR data array, there would have to be some teaching or suggestion of a mechanism arranged to read a particular subset of the PAR data for a particular category of movement that would correspond to a avatar movement from its current position into a position within range of a zone boundary to render claim 1 obvious.

No such disclosure is present. This is hardly surprising given that Yerazunis is not concerned with identifying potential movement to a position within range of a zone boundary.

Accordingly, Appellant respectfully submits that claims 1, 3-5, 7-14, 16-21, 23-29 and 33-34 are not "obvious" under 35 U.S.C. §103 over Yerazunis and Suzuki and therefore respectfully requests that the rejection of these claims be reversed.

Claims 2, 6, 15, 22, 30 and 32 are not "obvious" under 35 U.S.C. §103 over Yerazunis in view of Suzuki and further in view of Leahy et al (U.S. '045, hereinafter "Leahy"). Claim 31 is not "obvious" under 35 U.S.C. §103 over Yerazunis in view of Suzuki and further in view of Cohen-Or (U.S. '567). Each of Leahy and Cohen-Or fails to remedy the above described deficiencies of Yerazunis and Suzuki with respect to the claimed invention. Appellant therefore respectfully requests that the above rejections under 35 U.S.C. §103 be reversed.

CONCLUSION

In conclusion it is believed that the application is in clear condition for allowance; therefore, early reversal of the Final Rejection and passage of the subject application to issue are earnestly solicited.

Respectfully submitted,

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(VIII) CLAIMS APPENDIX

1. A terminal for providing a virtual environment interface to server means which maintains said virtual environment as a plurality of zones, comprising:

a client providing a user interface to the virtual environment to allow a user to control an avatar in the virtual environment; and

apparatus for estimating the likelihood of said avatar, under the control of said user in the virtual environment, moving within a predetermined range of a boundary, the apparatus comprising:

recording means for recording the position of the avatar at intervals to obtain movement data;

means for storing data as to the relative frequency of occurrence of different categories of said movement;

means arranged to read, from the stored data, frequency data for categories of movement such as would correspond to a potential movement of the avatar from its current position into a position within said predetermined range of said boundary;

wherein the client is arranged to obtain information from said server means about the status of the adjacent zone before the avatar enters the adjacent zone only when the likelihood of the avatar moving within the predetermined range of the boundary of said adjacent zone is above a threshold.

2. The terminal according to claim 1 wherein said threshold is determined in dependence upon a cost function.

3. The terminal according to claim 1 wherein said threshold is determined in dependence upon the amount of communication traffic and/or the time taken for the communication with the server means.

4. The terminal according to claim 1 wherein said means for storing data is arranged to discard data relating to movement after a set period of time.

5. The terminal according to claim 1 wherein said recording means is adapted to record the position of said avatar at regular intervals of time in said virtual environment.

6. The terminal according to claim 1 wherein the potential movement of the avatar takes into consideration obstructions to the movement of said avatar within said virtual environment.

7. The terminal according to claim 1 wherein said predetermined range is dependent upon a range of awareness of said avatar within which said avatar can experience the virtual environment.

8. The terminal according to claim 1 wherein said categories of movement are determined by run lengths.

9. The terminal according to claim 1 wherein said categories of movement are determined by run lengths within a predefined corridor.

10. The terminal according to claim 1 wherein said categories of movement are determined by the movement of said avatar into areas around said avatar.

11. The terminal according to claim 1 wherein said categories of movement are determined by directions and distances of movement of said avatar.

12. An apparatus for estimating the likelihood of an avatar, under the control of a user in a virtual environment, moving within a predetermined range of a boundary, the apparatus comprising:

recording means for recording the position of the avatar at intervals to obtain movement data;

means for storing data as to the relative frequency of occurrence of different categories of said movement; and

means arranged to read, from the stored data prior to the avatar moving across the boundary, frequency data for categories of movement such as would correspond to a potential movement of the avatar from its current position into a position within said predetermined range of said boundary.

13. The apparatus according to claim 12 wherein said means for storing data is arranged to discard data relating to movement after a set period of time.

14. The apparatus according to claim 12 wherein said recording means is adapted to record the position of said avatar at regular intervals of time in said virtual environment.

15. The apparatus according to claim 12 wherein the potential movement of the avatar takes into consideration obstructions to the movement of said avatar within said virtual environment.

16. The apparatus according to claim 12 wherein said predetermined range is dependent upon a range of awareness of said avatar within which said avatar can experience the virtual environment.

17. The apparatus according to claim 12 wherein said categories of movement are determined by run lengths.

18. The apparatus according to claim 12 wherein said categories of movement are determined by run lengths within a predefined corridor.

19. The apparatus according to claim 12 wherein said categories of movement are determined by the movement of said avatar into areas around said avatar.

20. The apparatus according to claim 12 wherein said categories of movement are determined by directions and distances of movement of said avatar.

21. A system for providing a distributed virtual environment comprising:

one or more servers for maintaining said virtual environment as a plurality of zones, said one or more servers receiving communication from a client to allow a user to control an avatar in the virtual environment; and

an apparatus for predicting the likelihood of said avatar moving within a predetermined range of a boundary of a zone in the virtual environment;

wherein said one or more servers is arranged to communicate with the client to provide information on the status of one or more further zones in the virtual environment before the avatar enters said one or more further zones when the likelihood of the avatar moving within a predetermined range of the boundary of said one or more further zones predicted by the apparatus is above a threshold.

22. The system according to claim 21 wherein said threshold is determined in dependence upon a cost function.

23. The system according to claim 21 wherein said threshold is determined in dependence upon the amount of communication traffic and/or the time taken for the communication with the one or more servers.

24. A method of operating a computer terminal to provide a virtual environment interface to server means which maintain said virtual environment as a plurality of zones, the method comprising:

controlling a client which provides a user interface to the virtual environment to allow a user to control an avatar in the virtual environment; and

estimating the likelihood of said avatar, under the control of said user in a virtual environment, moving within a predetermined range of a boundary, estimating said likelihood comprising:

recording the position of the avatar at intervals to obtain movement data;

storing data as to the relative frequency of occurrence of different categories of said movement; and

reading, from the stored data, frequency data for categories of movement such as would correspond to a potential movement of the avatar from its current position into a position within said predetermined range of said boundary; and

instructing the client to obtain information from said server means about the status of an adjacent zone before the avatar enters the adjacent zone only when the likelihood of the avatar moving within the predetermined range of the boundary of said adjacent zone is above a threshold.

25. The method according to claim 24 wherein said threshold is determined in dependence upon the amount of communication traffic and/or the time taken for the communication with the server means.

26. The method according to claim 24 wherein stored movement data is discarded after a set period of time.

27. A storage medium readable by a computer, tangibly embodying a program of instructions executable by the computer to carry out a method of operating a computer terminal to provide a virtual environment interface to a server which maintains the virtual environment as a plurality of zones, steps of the method comprising:

controlling a client which provides a user interface to the virtual environment to allow a user to control an avatar in the virtual environment; and

estimating the likelihood of said avatar, under the control of said user in a virtual environment, moving within a predetermined range of a boundary, estimating said likelihood comprising:

recording the position of the avatar at intervals to obtain movement data;

storing data as to the relative frequency of occurrence of different categories of said movement; and

reading, from the stored data, frequency data for categories of movement such as would correspond to a potential movement of the avatar from its current position into a position within said predetermined range of said boundary; and

instructing the client to obtain information from said server about the status of an adjacent zone before the avatar enters the adjacent zone only when the likelihood of the avatar moving within the predetermined range of the boundary of said adjacent zone is above a threshold.

28. A computer-implemented method for processing signals related to provide a virtual environment interface to at least one server which maintains said virtual environment as a plurality of zones, the method comprising:

controlling a client which provides a user interface to the virtual environment to allow a user to control an avatar in the virtual environment; and

estimating the likelihood of said avatar, under the control of said user in a virtual environment, moving within a predetermined range of a boundary, estimating said likelihood comprising:

recording the position of the avatar at intervals to obtain movement data;

storing data as to the relative frequency of occurrence of different categories of said movement; and

reading, from the stored data, frequency data for categories of movement such as would correspond to a potential movement of the avatar from its current position into a position within said predetermined range of said boundary; and

instructing the client to obtain information from said server about the status of an adjacent zone before the avatar enters the adjacent zone only when the likelihood of the avatar moving within the predetermined range of the boundary of said adjacent zone is above a threshold.

29. In a computer system having at least one server for providing a virtual environment having a plurality of zones in which an avatar may move in response to user control signals received from a client, a method comprising:

monitoring movement of the avatar within the virtual environment for a period of time;

determining a pattern of movement of the avatar based on the monitored movement;

predicting a likelihood of the avatar, based on the determined pattern of movement, of moving to within a predetermined range of a boundary of a zone in which the avatar is currently positioned;

determining whether or not the predicted likelihood exceeds a threshold; and

obtaining information for a zone adjacent to the zone in which the avatar is currently positioned before the avatar enters the adjacent zone when the predicted likelihood exceeds the threshold.

30. The method of claim 29 wherein the threshold is determined in dependence upon a cost function, the amount of communication traffic of the at least one server, or an amount of time taken for the communication with the at least one server.

31. The method of claim 29 wherein monitoring the movement of the avatar includes obtaining a sliding window of data samples describing the avatar movement.

32. The method of claim 29 wherein predicting the likelihood of the avatar of moving to within the predetermined range of the boundary includes considering features within the virtual environment which restricts movement of the avatar.

33. The method of claim 29 wherein predicting the likelihood of the avatar of moving to within the predetermined range of the boundary includes considering features within the virtual environment which restricts an ability of the avatar to experience the virtual environment.

34. The method of claim 29 wherein predicting the likelihood of the avatar of moving to within the predetermined range of the boundary includes referring to a prediction model having a data table of run lengths of avatar movement and corresponding likelihood to cross a zone boundary.

(IX) EVIDENCE APPENDIX

None

(X) RELATED PROCEEDINGS APPENDIX

None